

### PENDING CLAIMS

16. A method for increasing the signal-to-noise ratio in the characteristic optical response of an array having subpopulations of sensor elements comprising:

- a) providing an array comprising:
  - i) at least a first subpopulation comprising first sensor elements; and
  - ii) a second subpopulation comprising second sensor elements;
- b) contacting said array with a composition comprising at least a first target analyte;
- c) obtaining a first measurement from at least two of said sensor elements of at least one of said subpopulations;
- d) summing said first measurements from said sensor elements; and
- e) performing a statistical analysis on said first measurements.

17. The method according to claim 16 further comprising obtaining at least a first control measurement and adjusting the baseline of said first measurement against said first control measurement.

18. The method according to claim 16 wherein the signal-to-noise ratio is increased by a factor of at least 10.

19. The method of claim 16 wherein an analyte detection limit is reduced by a factor of at least 100.

20. The method of claim 16, 25 or 27, wherein said sensor elements are beads and said array comprises a population of beads dispersed on a substrate.

21. The method of claim 20 wherein said substrate is a fiber optic bundle.

22. The method of claim 20 further comprising identifying the location of each sensor

element within each sensor subpopulation within the array.

23. The method according to claim 16 wherein said sensor elements comprise chemical functional groups.

24. The method according to claim 16 wherein said sensor elements comprise oligonucleotides.

25. A method for amplifying the characteristic optical response of an array having subpopulations of sensor elements comprising:

- a) providing an array comprising:
  - i) at least a first subpopulation comprising first sensor elements; and
  - ii) a second subpopulation comprising second sensor elements;
- b) contacting said array with a composition comprising at least a first target analyte;
- c) obtaining a first measurement from at least two of said sensor elements of at least one of said subpopulations; and
- d) summing the optical responses.

26. A method according to claim 25 further comprising obtaining at least a first control measurement and adjusting the baseline of said first measurement using said first control measurement.

27. A method comprising:

- a) providing an array with a plurality of subpopulations of sensor elements;
- b) contacting said array with a composition comprising at least a first target analyte;
- c) obtaining first and second measurements from at least first and second sensor elements, respectively, from at least a first subpopulation; and
- d) performing a statistical analysis on said first and second measurements.

28. The method according to claim 16, 25 or 27, wherein each subpopulation comprises a bioactive agent.

29. The method according to claim 28, wherein at least one of said bioactive agents is a nucleic acid.

30. The method according to claim 28, wherein at least one of said bioactive agents is a protein.

31. The method according to claim 20, further comprising determining outlying beads and excluding outlying beads from said subpopulation.

32. The method according to claim 16, 45 or 27, wherein said statistical analysis comprises calculating the mean of at least said first and second measurements.

33. The method according to claim 16, 45 or 27, wherein said statistical analysis comprises calculating the standard deviation of at least said first and second measurements.

34. The method according to claim 16, 45 or 27, further comprising evaluating the statistical validity of said measurements.

35. The method according to claim 16, 45 or 27, further comprising performing a second statistical analysis on said measurements.

36. The method according to claim 35 wherein said second statistical analysis comprises evaluating said measurements using confidence intervals.

37. The method according claim 35, wherein said second statistical analysis comprises using said measurements to perform hypothesis testing.

38. The method according to claim 16, 45 or 27, further comprising comparing said statistical analysis of measurements obtained from at least two subpopulations.

39. The method according to claim 38, wherein said statistical analysis comprises performing a cluster analysis of said subpopulation.

40. A method comprising:

a) providing an array comprising beads on a substrate comprising a plurality of subpopulations of sensor elements, wherein each sensor element comprises a bioactive agent that will bind a target analyte, and at least two of said subpopulations comprise different bioactive agents that will bind the same target analyte;

b) contacting said array with a composition comprising at least a first target analyte;

c) obtaining a measurement from the optical response of each sensor element;  
and

d) performing a statistical analysis on said measurements from each sensor element.

41. The method according to claim 40, wherein at least two of said subpopulations each comprise bioactive agents that will bind different target analytes.

42. The method according to claim 41, wherein at least one of said bioactive agents is a nucleic acid.

43. The method according to claim 41, wherein at least one of said bioactive agents is a protein.

44. The method according to claim 40, further comprising, determining outlying beads and excluding outlying beads from said subpopulation.

45. The method according to claim 25, further comprising:  
e) performing a statistical analysis on said measurements of at least one of said subpopulations.
46. The method according to claim 16, 25, 27 or 40, wherein said substrate is selected from the group consisting of glass and plastic.
47. The method according to claim 20, wherein said substrate is selected from the group consisting of glass and plastic.
48. The method according to claim 17 or 26 wherein said adjusting comprises subtracting said first control measurement from said first measurement.